

Case Report

Rheumatoid pneumoconiosis (Caplan's syndrome): a case report

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Abstract: Caplan's syndrome, also referred to as rheumatoid pneumoconiosis (RP), is specific to rheumatoid arthritis (RA) and presents with multiple, well-defined necrotic nodules in workers exposed to dust. Here we report one case with a typical pulmonary presentation, confirmed through computed tomography (CT) and histopathological studies. A 58-year-old male patient with a diagnosis of RA, complained pain of multiple joints and mild dyspnea on exertion. He was an active smoker (40 pack-years) and worked as a shepherd for 35 years exposed to dust. High-resolution CT (HRCT) of the chest revealed bilateral, round, well-delimited nodules with peripheral distribution. After one month of treatment with corticosteroids and tripterygiumwilfordii, the patient's pain and dyspnea improved. In the meantime, pulmonary nodules grew down gradually. The case demonstrates the clinical presentation, radiological and pathological features of Caplan's syndrome. The effective treatment for Caplan's syndrome is corticosteroids and tripterygiumwilfordii.

Keywords: Pneumoconiosis, rheumatoid arthritis, Caplan's syndrome, silicosis

Introduction

Caplan's syndrome, also referred to as rheumatoid pneumoconiosis (RP), is specific to rheumatoid arthritis (RA) and presents with multiple, well-defined necrotic nodules in workers exposed to dust (silica, coal). Prevalence is higher among patients with silicosis, despite the fact that it was originally described in coal workers with pneumoconiosis. The incidence varies among different areas of the world. A recent autopsy study compared the prevalence of RP among patients with coal worker's pneumoconiosis between the USA and Japan. The prevalence was 0.74% in Japan and 0.89% in the USA [1]. In China, clinical case published was rare. No report described rheumatoid lung nodules in an shepherd with no other initial signs of rheumatoid disease. Here we report one case with a typical pulmonary presentation, confirmed through computed tomography (CT) and histopathological studies.

Case report

A 58-year-old male patient was referred to our facility suspected of having pulmonary shadow

in the lung for two years with no other initial signs of rheumatoid disease. He complained pain of multiple joints eight months later. The patient reported an eight months history of polyarthritis in the hands, feet, and knees, accompanied by condition aggravation. On physical examination, he presented slightly increased hand joint volume and ulnar deviation at the wrist, which is consistent with a diagnosis of RA. He had been using prednisone 30 mg. He was an active smoker (40 pack-years) and worked as a shepherd for 35 years exposed to dust.

Upon physical examination, he presented good overall health status, without symptoms of RA. His breathing was normal, with a respiratory rate of 20 breaths per minute, his heart rate was rhythmic (72 beats per minute), pulmonary auscultation revealed the weakened pulmonary alveolar respiratory sounds of right lung, without any rales and rhonchi, and his SpO₂ was 94% on room air. Furthermore redness and swelling were found in his proximal metacarpophalangeal and interphalangeal joints of tow hands.



Figure 1. In A: Hand X-rays showing a symmetric decrease in joint spaces and periarticular osteoporosis in the proximal metacarpophalangeal and interphalangeal joints; In B: Swelling of soft tissue in the left ankle joint. (April 3, 2015).

Spirometry revealed an FVC of 2.92 L (72% of predicted), an FEV₁ of 2.24 L (69.4% of predicted), an FEV₁/FVC ratio of 0.76, and an FEF25-75% of 1.89 L/S (53.3% of predicted). The rheumatoid factor (RF) was 197.5 IU/mL, the test result for antinuclear factor was negative, and the erythrocyte sedimentation rate was 28 mm in the first hour.

Hand, wrist, ankle and foot X-rays showed early changes of rheumatoid arthritis and swelling of soft tissue in the left ankle joint (**Figure 1A, 1B**).

Chest X-rays revealed round, well-delimited nodules of various sizes (1-5 cm in diameter), bilaterally distributed at the periphery of the lungs, affecting the upper and lower halves of both lungs, together with larger, also peripheral, masses in both apices.

An HRCT scan of the chest revealed bilateral, round, well-delimited nodules with peripheral

distribution, together with nodules ≤ 5 cm, with the same characteristics, in the apices. The largest nodule was in the right upper lobe. Many of the opacities showed the formation of cavities and point calcifications. Small centrilobular nodules, with slight ground-glass attenuation, were observed in the upper regions of both lungs (**Figure 2A-D**).

A transbronchial lung biopsy of a 4-cm peripheral nodule located in the right upper lobe revealed, in the histopathological analysis, that there were several fibrotic nodules surrounded by necrotic tissue, lymphocytes and deposition of large amount of dust (**Figure 3A, 3B**).

Discussion

In 1953, Caplan described a characteristic radiographic pattern in coal miners with RA that was distinct from the typical progressive massive fibrosis pattern of coal workers' pneumoconiosis [2]. Caplan's syndrome, also known as rheumatoid pneumoconiosis (RP), is specific to RA and presents with multiple, well-defined necrotic nodules in workers exposed to dust. More specifically, inorganic dusts included silica from sources other than mining, asbestos and others [3]. The imaging features of RP were typical. Multiple nodules from about 0.5 to about several centimeters in diameter are distributed throughout the lungs but predominantly in the lung periphery. Lesions appear often in crops, may coalesce and form a larger confluent nodule. Nodules often cavitate or calcify [4].

In the present case, this patient worked as a shepherd for 35 years exposed to dust. Professions at risk include coal miners in underground and surface mining, other miners, e.g. gold miners, sandblaster workers, quarrymen, carbon electrode occupations, boiler scalers, asbestos workers and others [5]. Until now, the occurrence of Caplan's syndrome in shepherd has not been reported in the literature. An HRCT scan of the chest revealed bilateral, round, well-delimited nodules with peripheral distribution, together with nodules ≤ 5 cm, in the apices. The largest nodule was in the right upper lobe. Many of the opacities showed the formation of cavitations and point calcifications. Pulmonary function test indicated moderate limitation ventilation dysfunction and diffusion dysfunction. Physical examination showed that redness and swelling were found in his

Caplan's syndrome

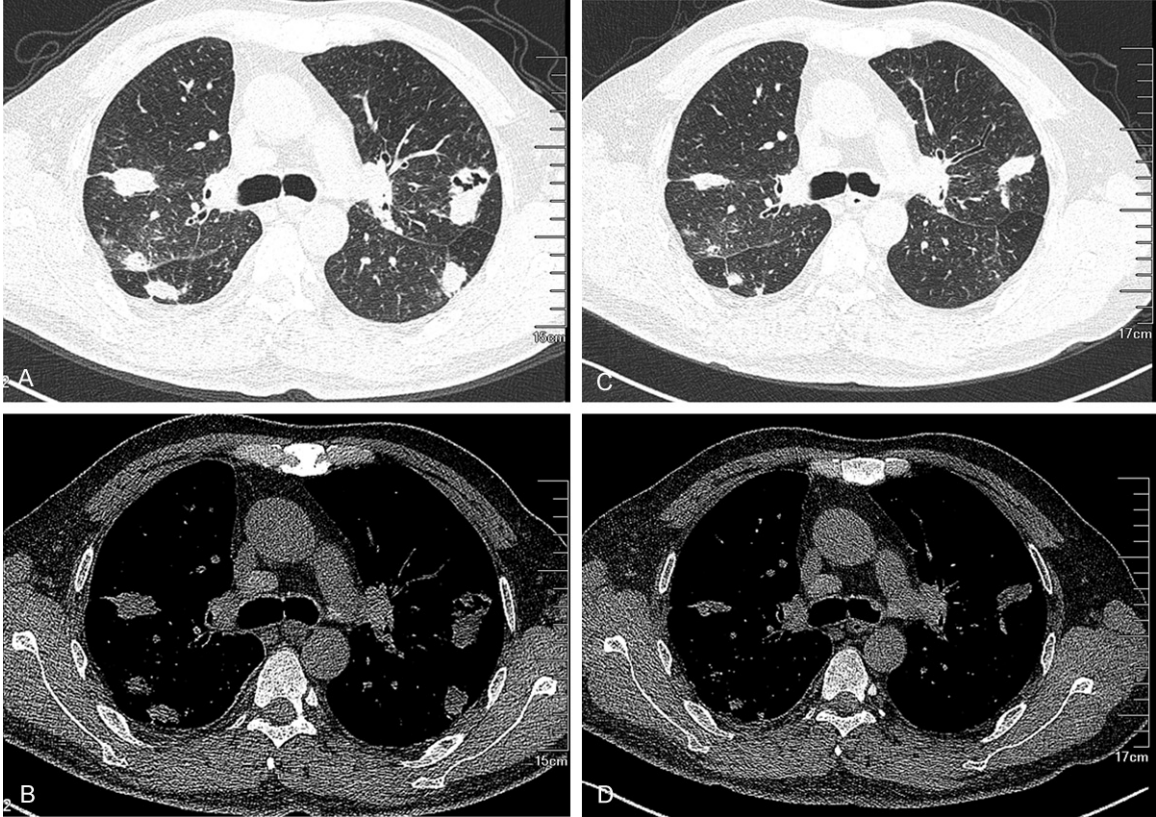


Figure 2. HRCT images showing nodules of various sizes, 1-5 cm in diameter, rounded, well delimited, distributed at the periphery of both lungs, In A, B: Before treatment (February 4, 2015); In C, D: After treatment (March 23, 2015).

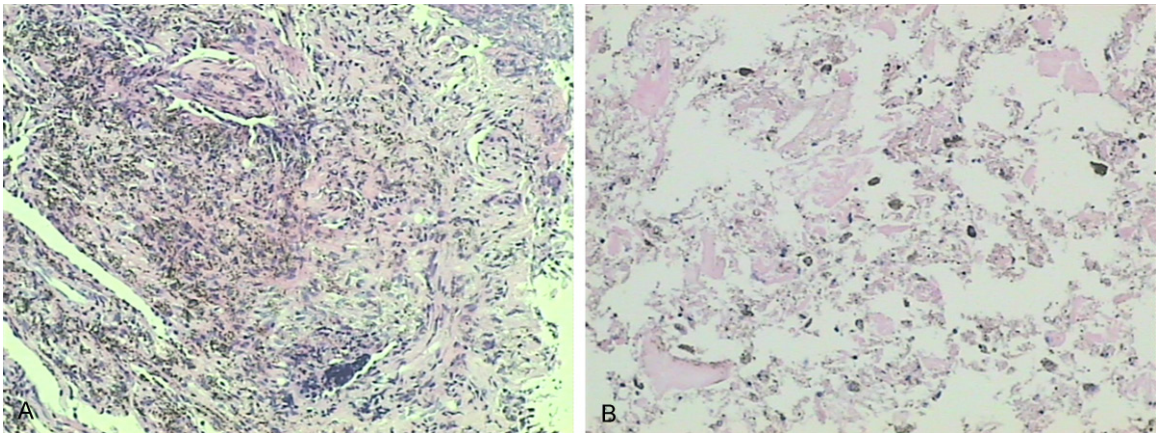


Figure 3. In A, B: Histopathological analysis of a sample collected through transbronchial lung biopsy, showing a rheumatoid nodule of loose collagen in concentric layers surrounded by fibrocytes and a palisade of macrophages. (H&E staining; magnification *200) (February 9, 2015).

proximal metacarpophalangeal and interphalangeal joints of tow hands. The RF was positive. In this case, tissue examination showed several fibrotic nodules, dust particle or carbon particle focal necrosis. Combining with the history, symptoms, signs, X-ray, imaging and path-

ological features, the diagnosis of RP was definite.

The pulmonary manifestations of RA are diverse, including necrobiotic nodules, interstitial disease, pleural abnormalities, bronchiolitis

Caplan's syndrome

obliterans, vasculitis, drug-induced lung disease, upper airway disease, organizing pneumonia and Caplansyndrome [6]. Both RA and rheumatoid factor is found more often in patients with RP compared to exposed miners with or without simple pneumoconiosis [7]. One study demonstrated RA was found in 55% of those with Caplannodules [8]. The patient in this case, initially proposed an infectious (fungi and tuberculosis) etiology of the nodules. As arthritis developed later in the course with circulating rheumatoid factor positive. Therefore, it can be concluded that RP is closely associated with the presence of RA. However, pulmonary nodules in RA patients without dust exposure are obviously extremely rare, whereas they were found in miners with silicosis with a frequency of about up to 1% in most reports [9]. Thus adding evidence to the observation of an association between silica/dust exposure and the occurrence of pulmonary nodules in RA patients. This has led to the hypothesis that RA might predispose to silicosis or accelerate its course.

From a pathological point of view, the classic type of "Caplan nodules" has been proposed: they contain a central necrotic area which is surrounded by alternate necrotic tissue and layers of black coal dust. Outside the dust ring is a zone of cellular infiltration with polymorphonuclear granulocytes, occasional giant cells and macrophages. The macrophages may contain dust particles [10].

The precise pathogenesis of RP is still a matter of debate. It has been hypothesized that silica particles are ingested by alveolar macrophages and result in inflammation and activation of fibroblasts. Silica may destroy the macrophages, and it is again digested by new macrophages. This repeated process leads to chronic immune activity and fibrosis. Systemically available silica may thus facilitate the formation of autoantigens. Pneumoconiosis has been linked to an increase in autoantibodies, immune complexes, and excess production of immunoglobulins including the RF, even in the absence of a specific autoimmune disease. It was also proposed that the synthesis of the RF in these patients is linked to an immunological cellular response to coal dust-induced pulmonary changes. Also it has been hypothesized, that silica may have an adjuvant effect on antibody production. Silica induces substances respon-

sible for joint destruction such as tumour necrosis factor (TNF)-alpha and interleukin 1. The activation of a great number of cytokines and cells such as fibroblasts by silica may provide the link for the development of autoimmune disease other than RA [2]. Although RP was described in workers exposed to silica or coal. However, this patient worked as a shepherd exposed to dust. It is highly speculative whether this might be inorganic dust from sheep or sand. So far there is little evidence for this.

The pulmonary nodules in RP are asymptomatic and do not require treatment unless a complication develops [11]. In a few cases, the use of corticosteroids has been described in slowing the progression of rapidly growing nodules [12]. The role of TNF inhibitors in the treatment of RP is unknown, but worsening of RA nodules has been reported with TNF use [13]. In this case, after one month of treatment with corticosteroids and tripterygiumwilfordii, the patient's pain and dyspnea improved. In the meantime, the pulmonary nodules grew down gradually. In addition, treatment should be focused on smoking cessation, limiting occupational exposure and controlling the extra pulmonary manifestations of the underlying RA.

Conclusions

In summary, the case demonstrates the clinical presentation, radiological and pathological features of Caplan's syndrome. It suggested the importance for differential diagnosis in the management of the patients suffered from pulmonary nodules with rheumatoid arthritis, especially from a pasturing area. The effective treatment for Caplan's syndrome is corticosteroids and tripterygiumwilfordii.

Disclosure of conflict of interest

None.

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